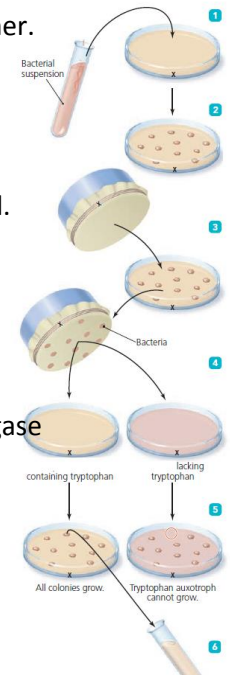
12. *Contrast the regulation of an inducible operon with that of a repressible operon. Give an example of each.*
    - **Inducible**:
        - Regulatory gene constantly transcribed making **lac operon** generally inactive.
        - E. Coli takes in lactose whenever available, converts it to allolactose.
        - Allolactose is an inducer that inactivates the repressor, thus lac operon genes are free and active
        - Lac operon then codes genes for lactose catabolism only when there is a demand by lactose
    - **Repressible**: Repressor genes, that inhibit amino acid synthesis, are usually inactive
        - **When tryptophan in environment is…**
            i. Available, it activates repressor gene and stops the production of tryptophan
            ii. Unavailable, the repressor gene is inactive and E. Coli synthesizes its own tryptophan

13. *Define mutation. Define point mutation and describe three types.*
    - A **mutation** is a change in the nucleotide base sequence(s).
    - **Point mutation**: single nucleotide base is affected.

14. *List three effects of point mutations. Describe frame-shift mutations.*
    - **Silent**: Redundancy in codons allow for reduction of error. **No change**.
    - **Missense**: A single nucleotide change causes change in **one specific amino acid**.
    - **Nonsense**: A single nucleotide change causes change from amino acid codon into **STOP codon**
    - **Frameshifts** involve inserting or deleting a nucleotide to shift the sequence of codons.

15. *Discuss how ionizing and non-ionizing radiation cause mutations in a genome. Give examples.*
    - **Ionizing**: X-rays and gamma rays energize electrons to break free and attack other atoms.
    - **Non-ionizing**: UV light causes adjacent pyrimidines (C,T,U) to covalently bond to each other.
        - This formation is called pyrimidine dimers.



16. *Are most mutations advantageous or deleterious?*
    - **Mostly deleterious**, because they cause non-functional proteins or abrupt transcription.
        - If cells cannot metabolize, they die and these mutation disappear from gene pool.
    - Mutations can be advantageous as they could help with survival, thus contribute to evolution.

17. *Describe the so-called light repair and dark repair mechanisms of DNA repair.*
    - **DNA photolyase** is an enzyme activated by visible light to break dimers.
    - Repair enzymes cut damaged DNA, then reconnected with DNA polymerase I and DNA ligase (occurs in either light or dark)

18. *Contrast positive selection and negative selection approaches to identifying bacterial mutants*
    - **Positive selection**: selecting a mutant by eliminating the normal phenotypes.
        - Example: isolating penicillin-resistant bacteria by spreading in penicillin
    - **Negative selection**: indirect method of selecting **auxotrophs** from normal phenotypes
        - Auxotrophs = mutant with differing nutritional requirements than normal